UNF-9058 A

We claim:

1. A device for the treatment of exhaust gases comprising:

a housing having an inlet at one end and an outlet at an opposite end through which exhaust gases flow;

a fragile structure resiliently mounted within said housing, said fragile structure having an outer surface and an inlet end surface at one end in communication with said inlet of said housing and an outlet end surface at an opposite end in communication with said outlet end of said housing;

a support element disposed between the housing and the fragile structure, said support element comprising an integral, substantially non-expanding ply of melt-formed ceramic fibers containing alumina and silica, said fibers having been prepared by a process including heat treating said fibers under a time-temperature regimen comprising heat treating said fibers at a temperature of 990°C to at least 1050°C for greater than 1 hour such that the treated fibers have about 5 to about 50 percent crystallinity as detected by x-ray diffraction, and a crystallite size of about 50Å to about 500Å; and

wherein said support element exerts a minimum residual pressure for holding said fragile structure within said housing of one of at least 4 psi after 200 cycles of testing at 900°C or at least 10 psi after 1000 cycles of testing at 750°C.

2. The exhaust gas treatment device of claim 1, wherein the fragile structure has a perimeter, at least a portion of which is integrally wrapped by the support element.

3. The exhaust gas treatment device of claim 1, wherein the ceramic fibers are aluminosilicate fibers.

4. The exhaust gas treatment device of claim 3, wherein the fibers are aluminosilicate comprising about 40 weight percent to about 60 weight percent alumina and about 60 weight percent to about 40 weight percent silica.

5. The exhaust gas treatment device of claim 1, wherein the fibers have average diameters ranging from about 1 microns to about 14 microns.

6. The exhaust gas treatment device of claim 5, wherein the fibers have average diameters ranging from about 3 microns to about 6.5 microns.

7. The exhaust gas treatment device of claim 1, wherein the fibers have less than about 10% shot.

8. The exhaust gas treatment device of claim 1, wherein the support element provides a minimum residual pressure for holding the fragile structure within the housing after 200 cycles of testing at 900°C of at least 10 psi.

9. The exhaust gas treatment device of claim 1, wherein the support element is prepared by the process comprising melt spinning the fibers; heat treating the fibers; and incorporating the fibers into mat form.

10. The exhaust gas treatment device of claim 1, wherein said exhaust gas treatment device is a catalytic converter.

11. The exhaust gas treatment device of claim 1, wherein said exhaust gas treatment device is a diesel particulate trap.

12. A device for the treatment of exhaust gases comprising:

a housing having an inlet at one end and an outlet at an opposite end through which exhaust gases flow;

a fragile structure resiliently mounted within said housing, said fragile structure having an outer surface and an inlet end surface at one end in communication with said inlet of said housing and an outlet end surface at an opposite end in communication with said outlet end of said housing;

a support element disposed between the housing and the fragile structure, said support element comprising an integral, substantially non-expanding ply of melt-formed ceramic fibers containing alumina and silica, said fibers having been prepared by a process of heat treating said fibers under a time-temperature regimen comprising heat treating said fibers at a temperature of greater than 1050°C for an effective amount of time such that the treated fibers have about 5 to about 50 percent crystallinity as detected by x-ray diffraction, and a crystallite size of about 50Å to about 500Å;

wherein said support element exerts a minimum residual pressure for holding said fragile structure within said housing of one of at least 4 psi after 200 cycles of testing at 900°C or at least 10 psi after 1000 cycles of testing at 750°C.

13. The exhaust gas treatment device of claim 12, wherein the fragile structure has a perimeter, at least a portion of which is integrally wrapped by the support element.

14. The exhaust gas treatment device of claim 12, wherein the ceramic fibers are aluminosilicate fibers.

15. The exhaust gas treatment device of claim 14, wherein the fibers are aluminosilicate comprising about 40 weight percent to about 60 weight percent alumina and about 60 weight percent to about 40 weight percent silica.

16. The exhaust gas treatment device of claim 12, wherein the fibers have average diameters ranging from about 1 microns to about 14 microns.

17. The exhaust gas treatment device of claim 16, wherein the fibers have average diameters ranging from about 3 microns to about 6.5 microns.

18. The exhaust gas treatment device of claim 12, wherein the fibers have less than about 10% shot.

19. The exhaust gas treatment device of claim 12, wherein the support element provides a minimum residual pressure for holding the fragile structure within the housing after 200 cycles of testing at 900°C of at least 10 psi.

20. The exhaust gas treatment device of claim 12, wherein the support element provides a minimum residual pressure for holding the fragile structure within the housing after 1000 cycles of testing at 750°C of at least 10 psi.

21. The exhaust gas treatment device of claim 12, wherein the support element is prepared by the process comprising melt spinning the fibers; heat treating the fibers; and incorporating the fibers into mat form.

22. The exhaust gas treatment device of claim 12, wherein the process comprises heat treating the fibers under a time-temperature regimen of heat treating at a temperature between 1100°C and about 1400°C for at least one hour.

23. The exhaust gas treatment device of claim 12, wherein the process comprises heat treating the fibers under a time-temperature regimen of heat treating at a temperature of at least about 1100°C for at least two hours.

24. The exhaust gas treatment device of claim 12, wherein the process comprises heat treating the fibers under time-temperature regimen of heat treating at a temperature of at least 1200°C for at least 10 minutes.

25. The exhaust gas treatment device of claim 22, wherein the support element provides a minimum residual pressure for holding the fragile structure within the housing after 1000 cycles of testing at 750°C of at least 20 psi.

26. The exhaust gas treatment device of claim 12, wherein said exhaust gas treatment device is a catalytic converter.

27. The exhaust gas treatment device of claim 12, wherein said exhaust gas treatment device is a diesel particulate trap.

~~28~~. A method for mounting a fragile structure having at least one inlet surface within a device having a housing to provide thermal insulation and mechanical shock resistance to the fragile structure, the method comprising:

providing a flexible support element comprising an integral, substantially non-expanding ply of melt-formed ceramic fibers containing alumina and silica, said fibers having an average diameter of from about 1 micron to about 14 microns, and having been heat treated under a time-temperature regimen of one of (i) heat treating said fibers at a temperature of 990°C to at least 1050°C for greater than 1 hour such that the treated fibers have about 5 to about 50 percent crystallinity as detected by x-ray diffraction, and a crystallite size of about 50Å to about 500Å, and (ii) heat treating said

fibers at a temperature of greater than 1050°C for an effective time such that the treated fibers have about 5 to about 50 percent crystallinity as detected by x-ray diffraction, and a crystallite size of about 50Å to about 500Å,

wrapping the flexible support element around the entire perimeter of at least a portion of the structure's surfaces adjacent to the inlet face,

forming a housing around the wrapped structure, and

radially compressing said support element between said structure and said housing,

wherein said support element includes means for exerting a minimum residual pressure for holding the fragile structure within the housing after 200 cycles of testing at 900°C of at least 4 psi or at least 10 psi after 1000 cycles of testing at 750°C.

29. The method as set forth in claim 28, wherein said ply has an uninstalled nominal thickness of about 3 mm to about 30 mm, an uninstalled nominal density of about 0.03 to about 0.3 grams per cubic centimeter, and an installed thickness of about 2 mm to about 8 mm.

30. The method as set forth in claim 28, wherein the flexible support element is further prepared by impregnation of said ply of said melt-formed ceramic fibers with a binder.

31. The method of claim 28, wherein the fibers have been heat treated under a time-temperature regimen of heat treating at a temperature between 1100°C and about 1400°C for at least one hour.

32. The method of claim 28, wherein the fibers have been heat treated under a time-temperature regimen of heat treating at a temperature of at least about 1100°C for at least two hours.

33. The method of claim 28, wherein the fibers have been heat treated under time-temperature regimen of heat treating at temperature of at least 1200°C for at least 10 minutes.

34. A method for preparing a mat structure containing aluminosilicate fibers comprising

providing melt-formed ceramic fibers containing alumina and silica, said fibers having an average diameter of from about 1 micron to about 14 microns, heat treating said fibers under a time-temperature regimen of one of (i) heat treating said fibers at a temperature of 990°C to at least 1050°C for greater than 1 hour such that the treated fibers have about 5 to about 50 percent crystallinity as detected by x-ray diffraction, and a crystallite size of about 50Å to about 500Å, and (ii) heat treating said fibers at a temperature of greater than 1050°C for an effective time such that the treated fibers have about 5 to about 50 percent crystallinity as detected by x-ray diffraction, and a crystallite size of about 50Å to about 500Å;

mixing said heat treated fibers with a binder to form a slurry;

incorporating the slurry into a mat structure; and

removing the binder.

35. The method of claim 34, wherein the ceramic fibers are aluminosilicate fibers.

36. The method of claim 35, wherein the fibers are aluminosilicate comprising about 40 weight percent to about 60 weight percent alumina and about 60 weight percent to about 40 weight percent silica.

37. The method of claim 34, wherein the fibers have average diameters ranging from about 1 microns to about 14 microns.

38. The method of claim 37, wherein the fibers have average diameters ranging from about 3 microns to about 6.5 microns.

39. The method of claim 34, wherein the fibers have less than about 10% shot.

40. The method of claim 34, wherein the binder is selected from the group consisting of aqueous based latexes of acrylics, styrene-butadiene, vinylpyridine, acrylonitrile, vinyl chloride, and polyurethane.